Hazards of Working Around Cranes

Key Concepts:

- Electrocution Hazards
- Caught-In, Compressed or Crushing Hazards
- Struck-By Hazards
- Other Hazards

Electrocution Hazards

Controlling the Problem:

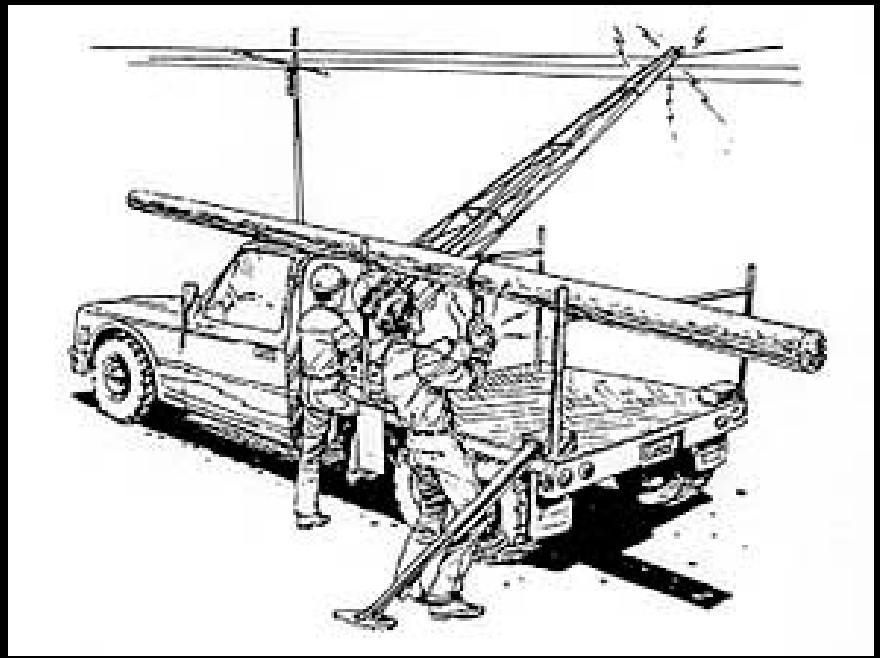
- OSHA power line clearance distances.
- ANSI requirements for working around power lines.
- Safe working clearance distance for cranes.
- Preventive measures for avoiding power line contacts.
- Planning for power line hazards.
- Dealing with power line emergencies.

Fatal Fact - Electrocution

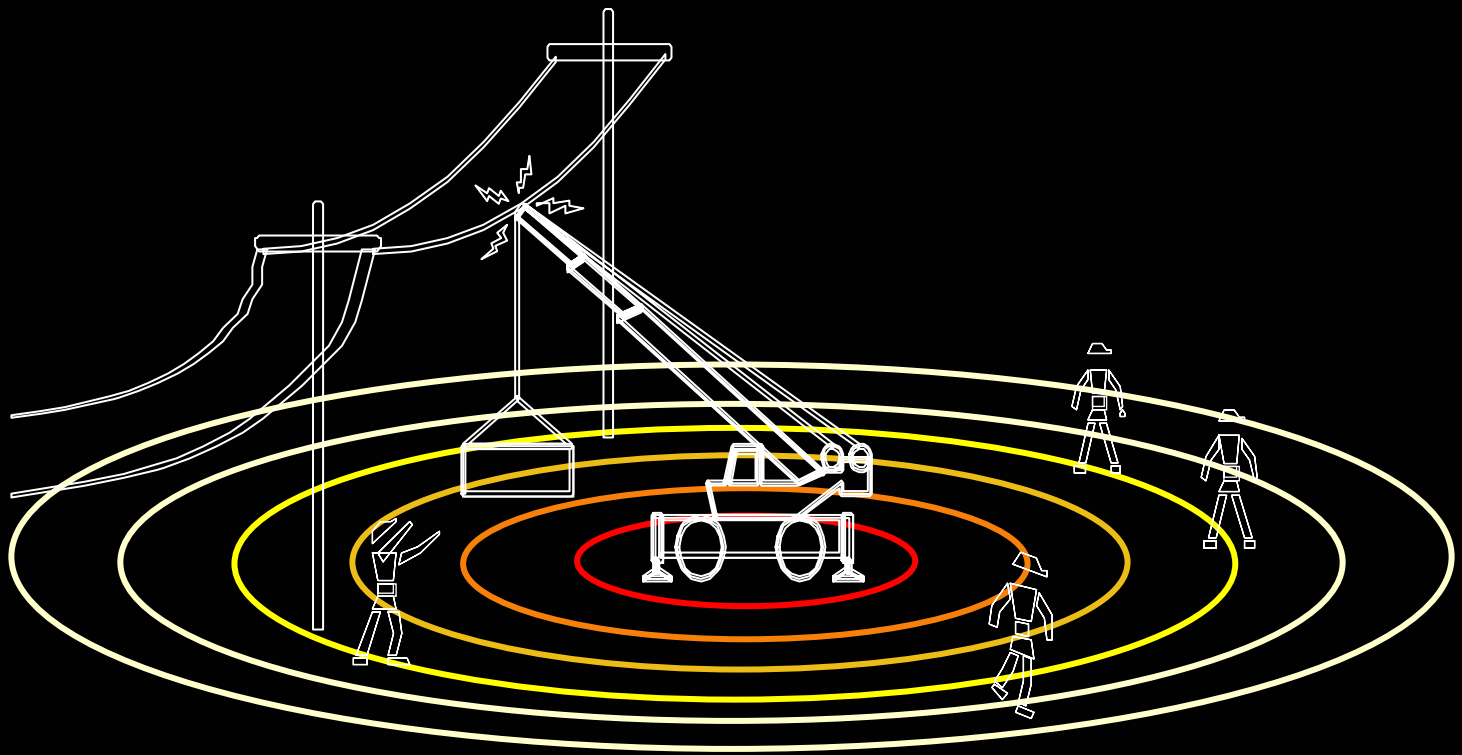
Weather	Sunny, Clear
Competent Person On-Site?	Yes – Victim
Safety Program?	No
Inspections Conducted?	Yes
Training Provided?	No
Experience of Victim	4 Months
Time on Project	4 Hours

Fatal Fact - Electrocution

Weather	Clear/Dry
Competent Person On-Site?	No
Safety Program?	Yes
Inspections Conducted?	No
Training Provided?	No
Experience of Victim	5 Years
Time on Project	1 Day



Dealing with Power Line Emergencies



Current can flow outward through ground in a ripple pattern from the equipment in contact with a power line.

Learning Opportunity

1. Name two (2) requirements about power line safety?

2. Name four (4) things a contractor can do to prevent a power line contact?

3. If a contractor contacts a power line, what are some things that either the operator or workers around the crane can do to prevent electrocution.

4. What minimum power line clearance does OSHA require when operating a crane near these power lines?
   1. 12kV power line_____feet
   2. 134kV power line_____feet

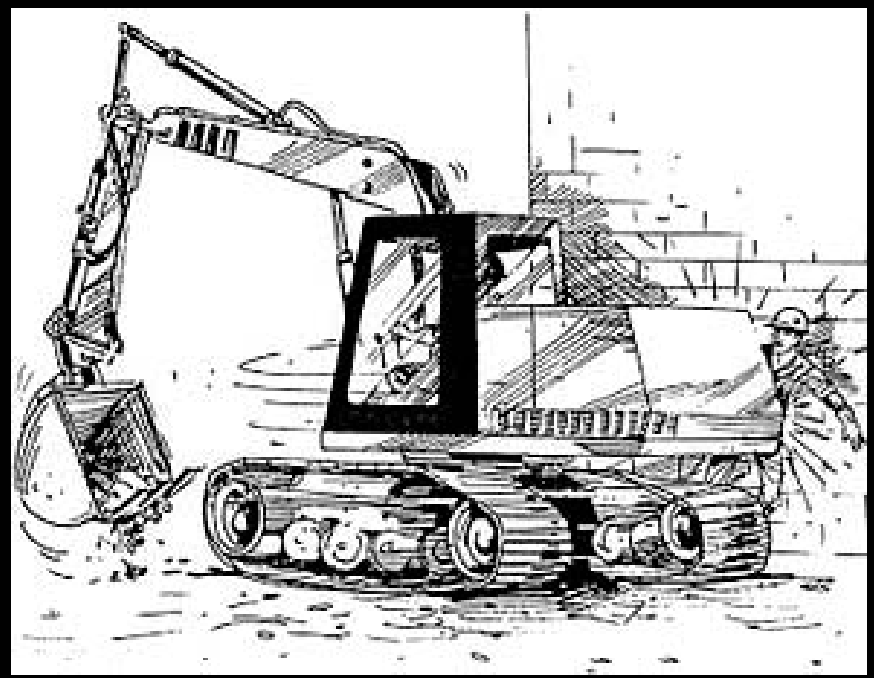
Caught-In, Compressed or Crushing Hazards

- Swinging superstructure of equipment.
- Exposure to moving parts.

Swinging Superstructure of Equipment

Fatal Fact - Crushing

Weather	Clear/Cool
Competent Person On-Site?	No
Safety Program?	No
Inspections Conducted?	No
Training Provided?	No
Experience of Victim	Unknown
Time on Project	4 Days



Exposure to Moving Parts

- Pinch Points

Learning Opportunity

1. Hazards associated with being caught-in, compressed or crushed while working around cranes and other material handling equipment include:

2. What can contractors do to prevent anyone from being crushed by the swinging superstructure of a mobile crane or other material handling equipment?

Struck-By Hazards

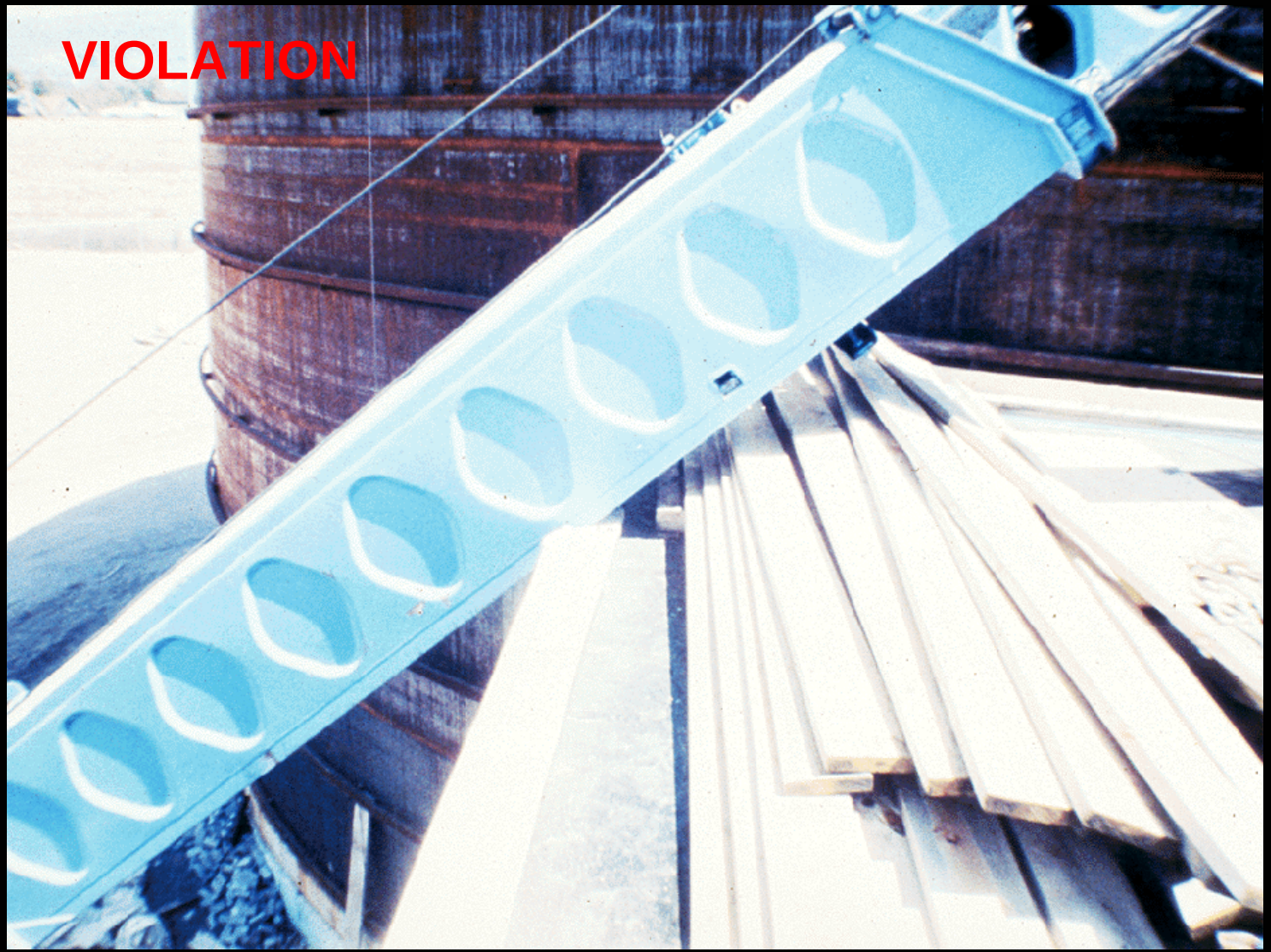
- Falling or failing loads
- Swinging loads

Falling & Failing Loads

To effectively manage the safe rigging and hoisting of loads, ensure:

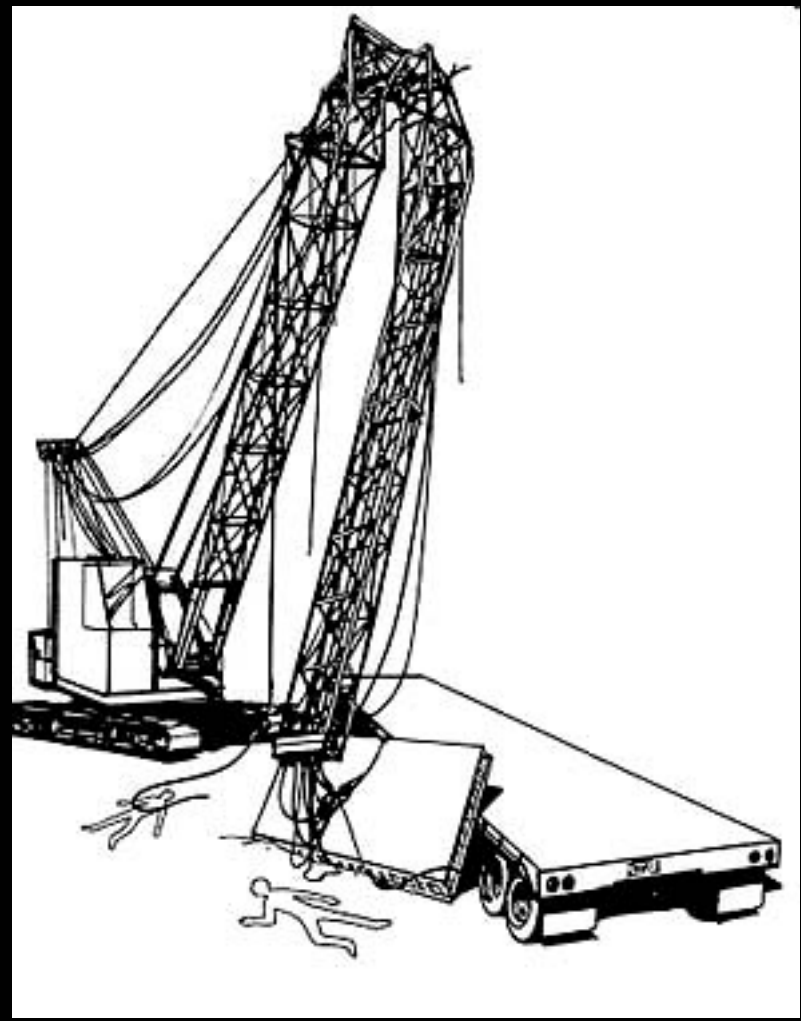
- A qualified rigger oversees all lifting operations.
- All rigging devices are used properly and are in good condition.
- Main hoisting line has been inspected, properly installed and maintained.
- Pre-critical lift evaluation performed (if applicable).

Never allow a crane boom to hit or touch any structure.



Fatal Fact - Struck-By

Weather	Clear
Inspections Conducted?	Yes
Competent Person On-Site?	Yes
Safety Program?	Yes
Training Provided?	Yes
Time on Job	1 Hour
Time on Task	1 Hour

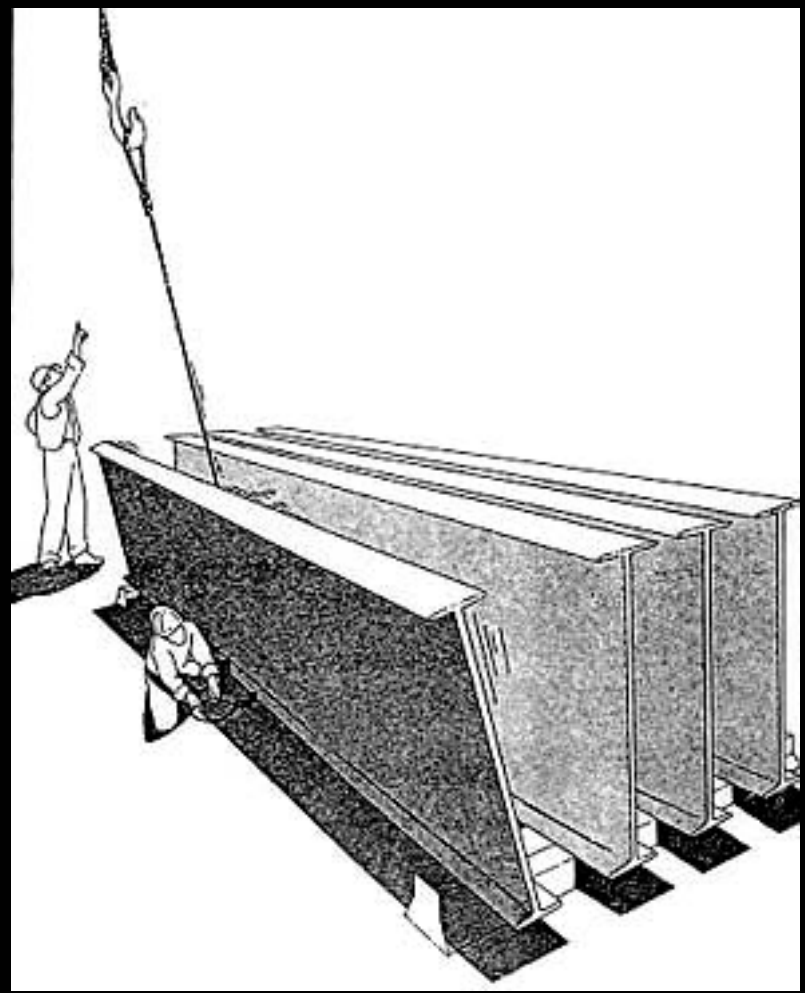


Four Basic Rules of Rigging

1. Know the Weight
2. Know the Capacity
3. Retain the Load
4. Control the Load

Fatal Fact - Struck-By/Crushed

Weather	Clear
Inspections Conducted?	Yes
Competent Person On-Site?	Yes
Safety Program?	Yes
Training Provided?	Yes
Experience of Victim	6 Months
Time on Project	2 Hours



Rigging Devices

The following is a discussion on:

- Shackles
- Hooks
- Wire Rope Clips
- Wedge Sockets
- Eyebolts
- Spreader Beams
- Slings

Types of Shackles

Recommended

Screw Pin Anchor Shackle

Not Recommended

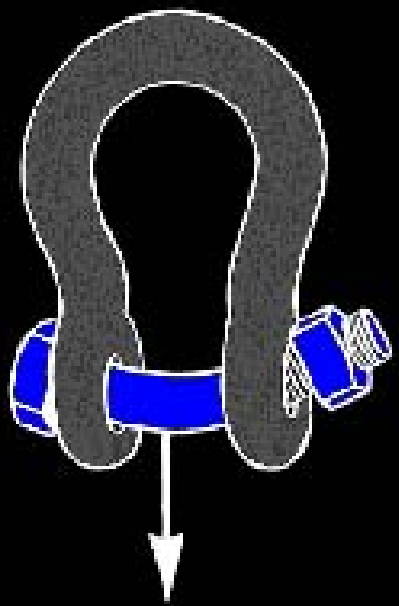
Round Pin Anchor Shackle

Recommended

Bolt Type Anchor Shackle

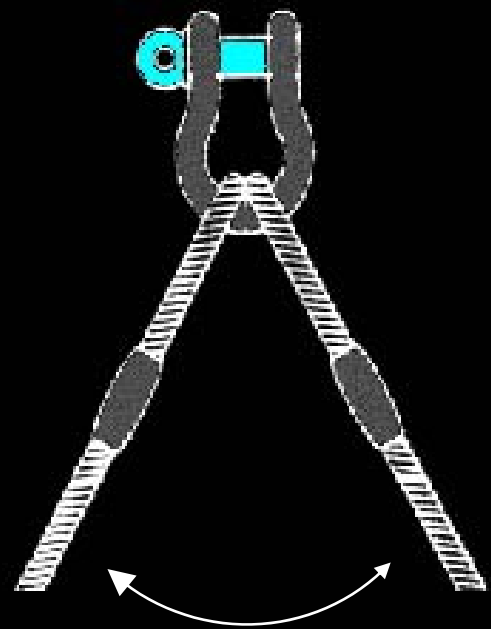
Proper Use of Shackles

Never replace a shackle pin with a bolt.



The load will bend the bolt.

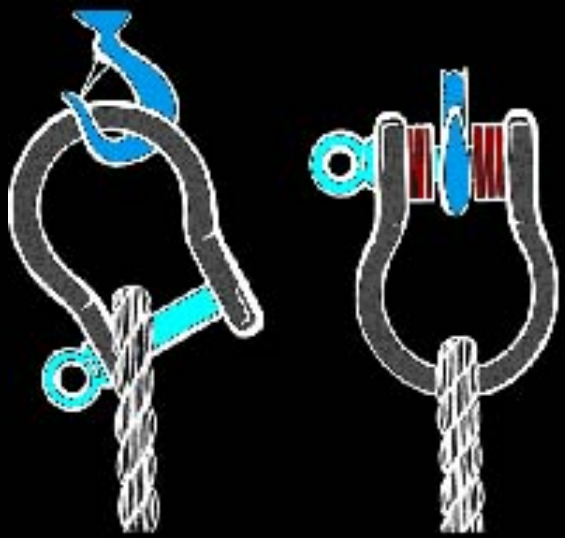
Check with manufacturer for specifications on Side Loading.



120 degree max.

Proper Use of Shackles

Avoid eccentric loads.



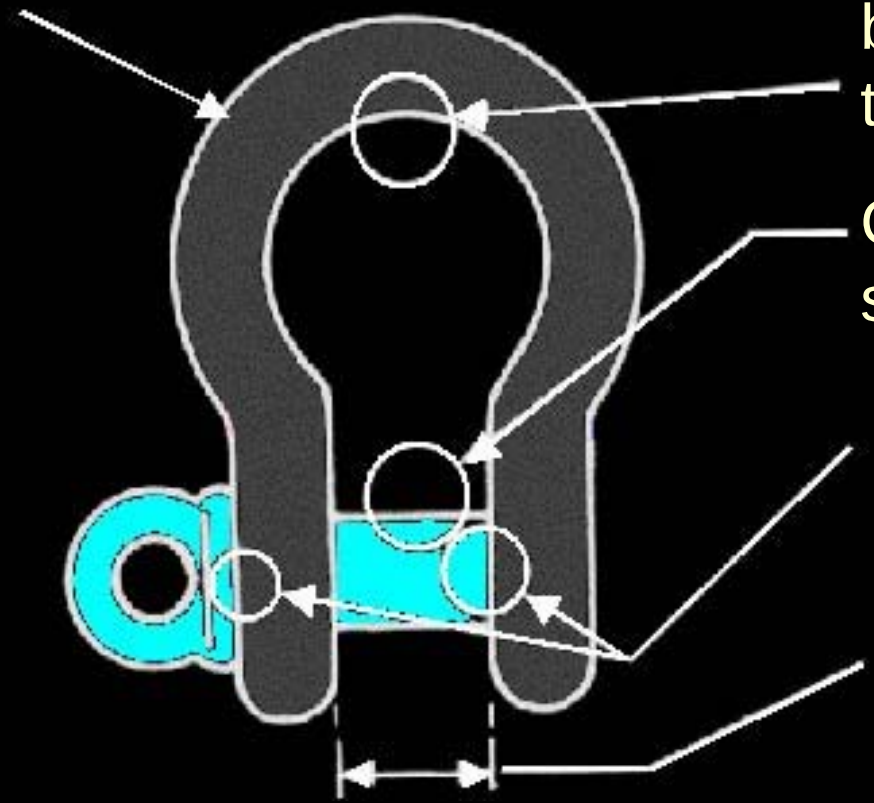
Bad Good

Proper chocking of shackles.

Bad Good

Shackle Inspection

Check wear



Check cracks, bending and twisting

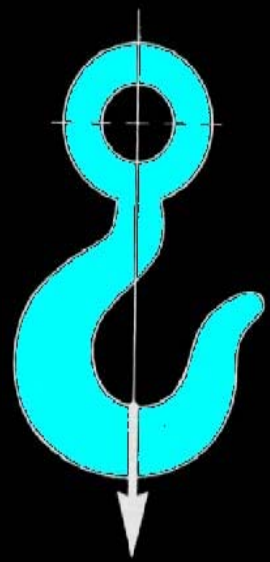
Check wear and straightness

Pin always seated

Check opening width

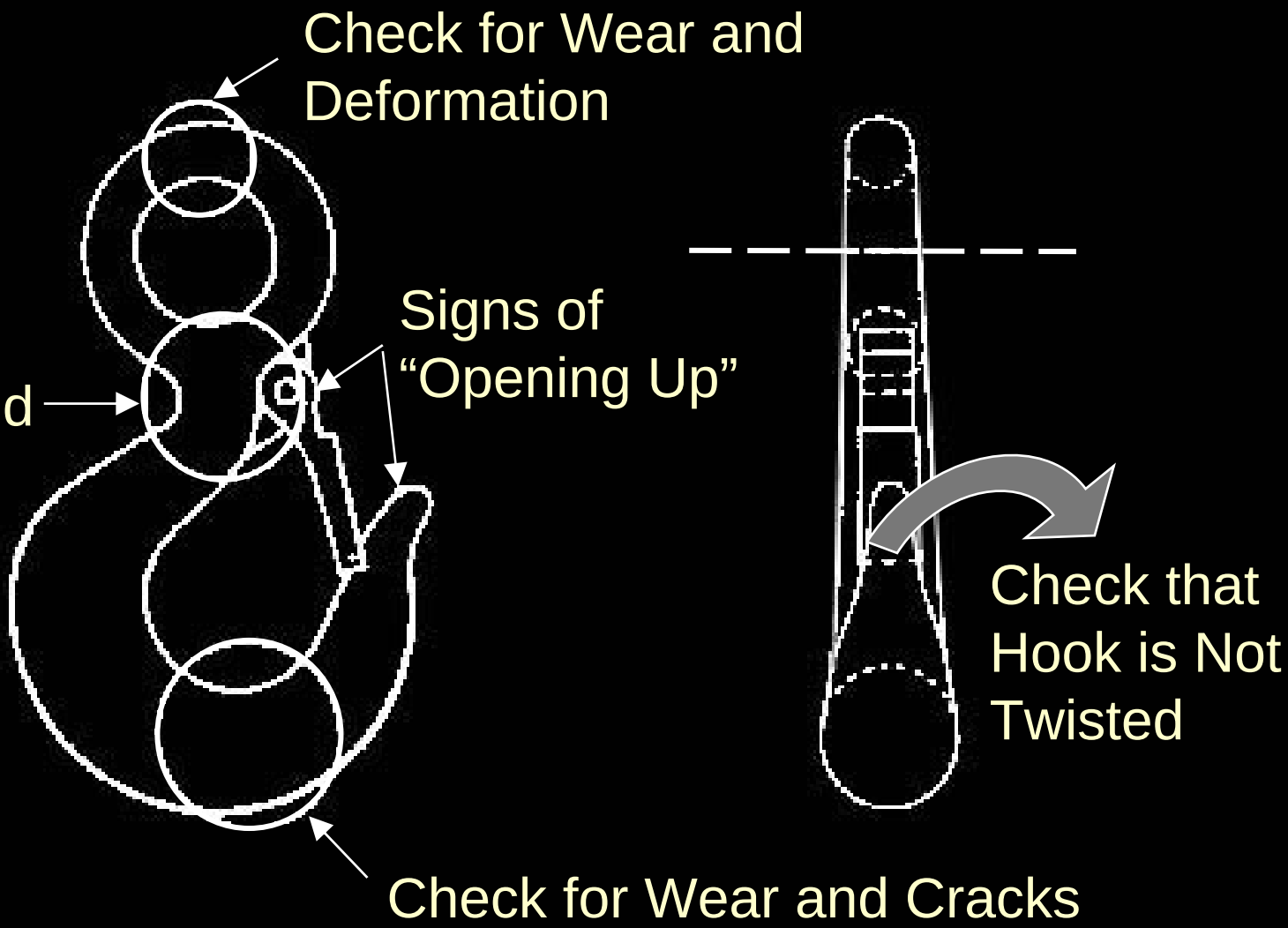
Hooks

- Manufacturers' identification.
- Never weld on hooks.
- Working safety latch.



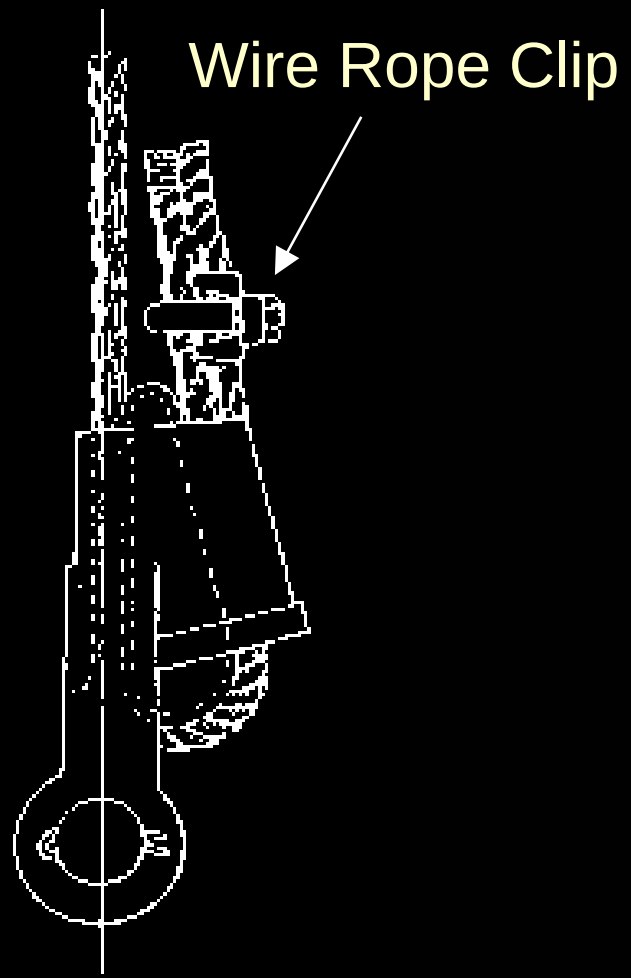
Hooks are designed to apply the load at the bottom of the saddle.

Hook Inspection Iteams

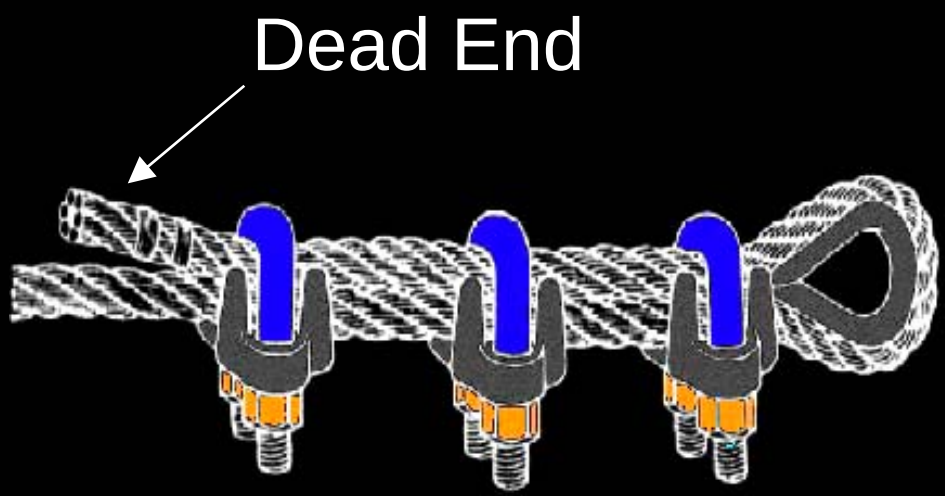


Wire Rope Clips

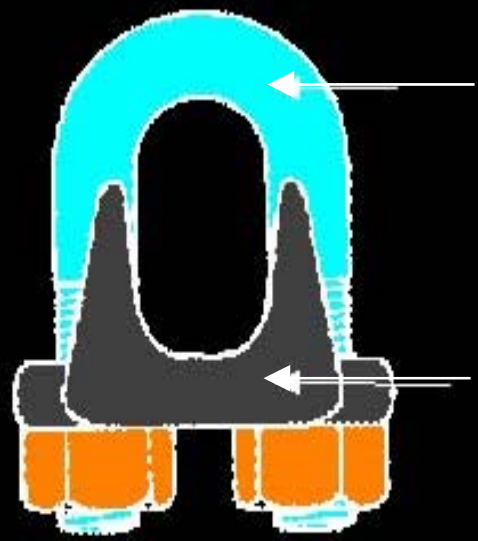
- The most common use of wire rope clips on cranes is at wedge and socket-end fittings.
- The clip does not provide strength to the wedge and socket connection.
- It is there to prevent the wedge from accidentally being released.



Installing Wire Rope Clips

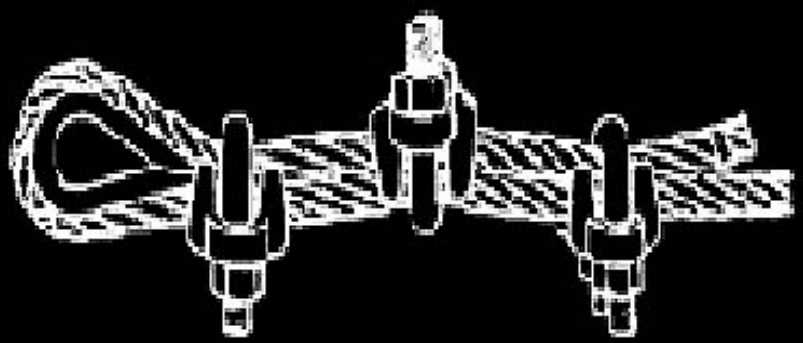


CORRECT



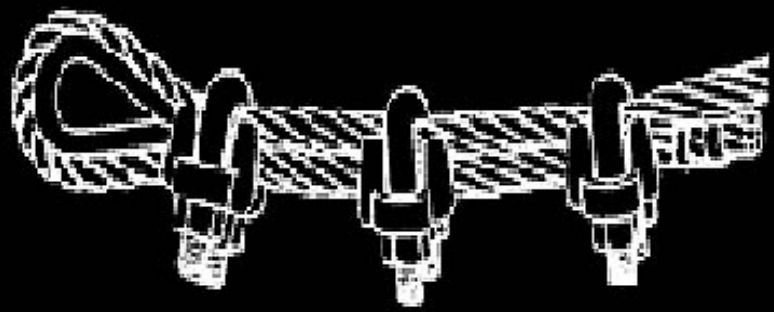
Installed properly as to *number*, *direction*, *spacing* and *torque*.

Examples of Improperly Installed Wire Rope Clips



INCORRECT

Do Not Alternate!

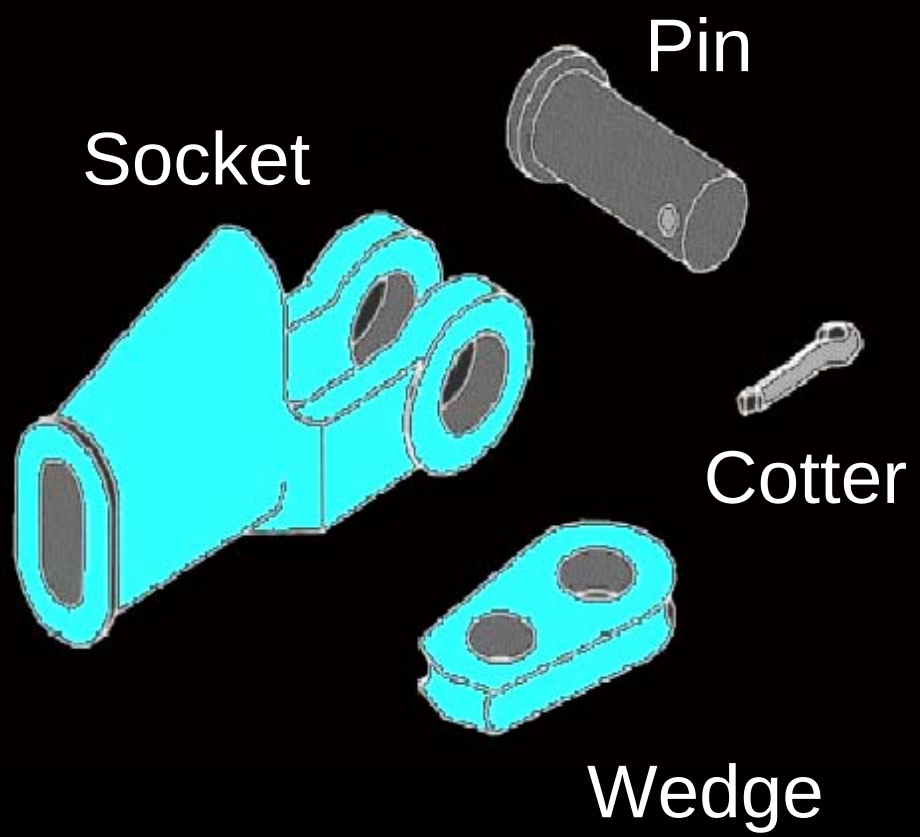


INCORRECT

Saddle is on Dead End!

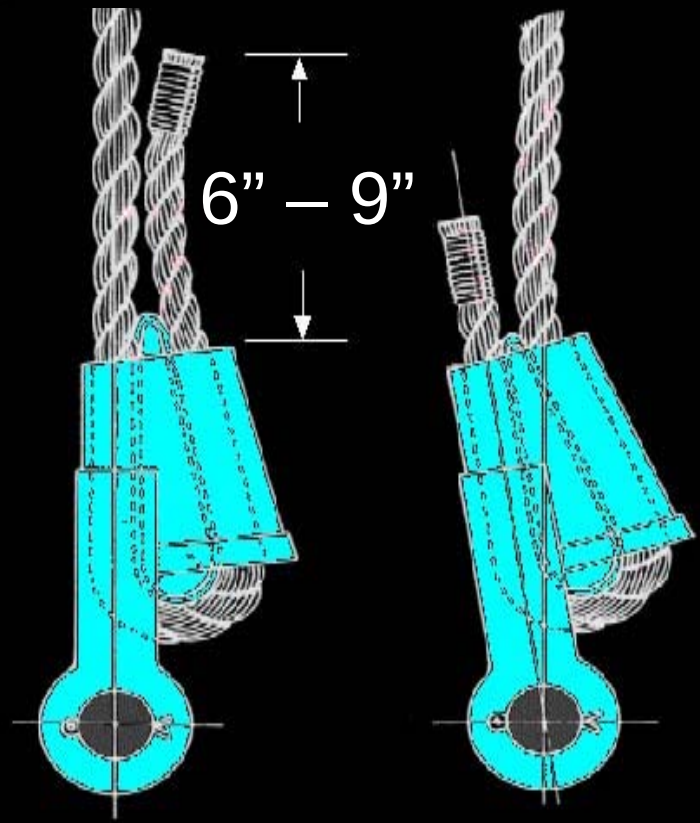
Wedge Sockets

- Most common method of terminating ropes on cranes.
- All parts must match in size.
- Measure rope diameter to ensure proper size.



Wedge Socket - Correct Rope Installation

- Live end of the rope, the straight side of the socket and the pinhole all line up.



Wedge Socket Damage

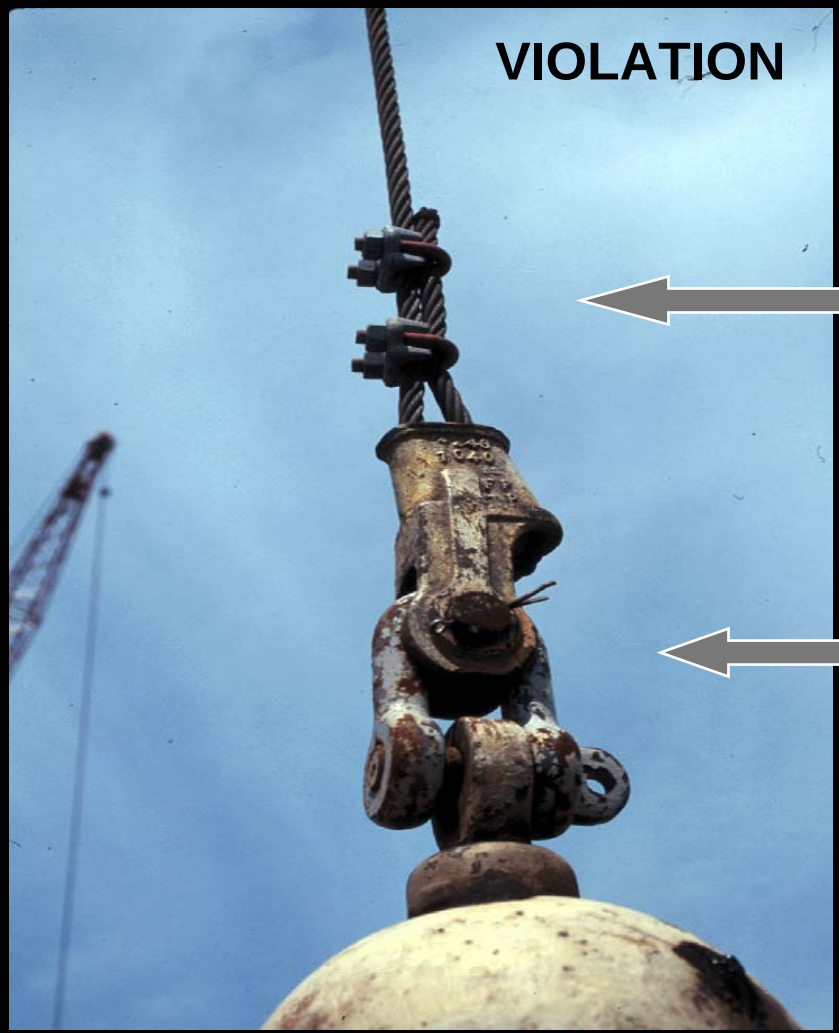
- May be necessary to beat the socket during installation.
- Socket may become mushroomed.
- Replace when damage becomes noticeable.

Acceptable Methods for Load Line Tieback

Single Grip, Single Saddle Wire Rope Clamp (One Single Saddle with U-bolt)

Double Grip, Double Saddle Wire Rope Clamp (Two Separate Saddles with U-Bolt)

Unacceptable Method for Load Line Tieback

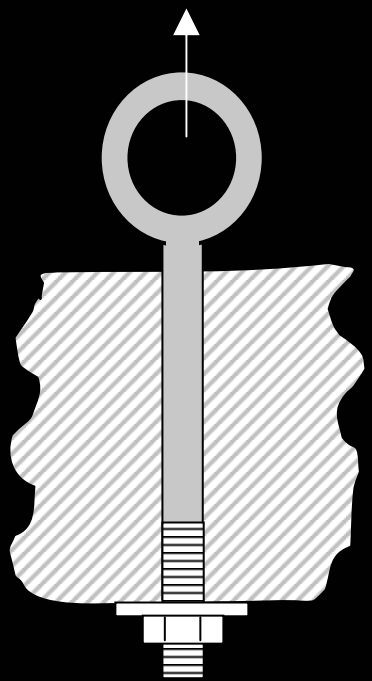


This type of wire rope clip (single grip, single saddle) will transfer the weight of the load to the dead end of the load line.

Attach the wedge socket directly to the load ball without the use of a shackle.

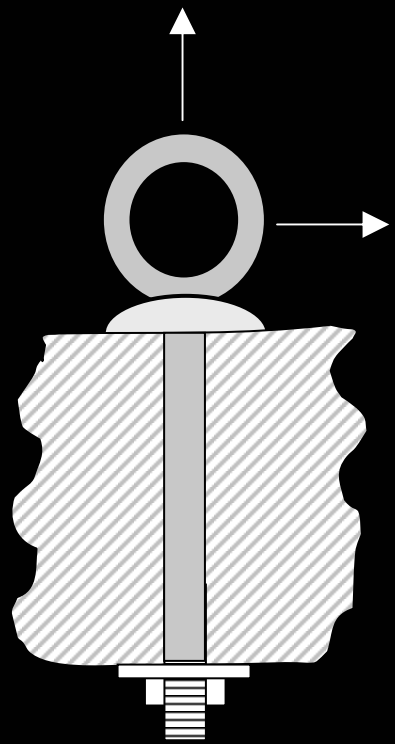
Eyebolts

Shoulderless eyebolts may be loaded in this direction only.



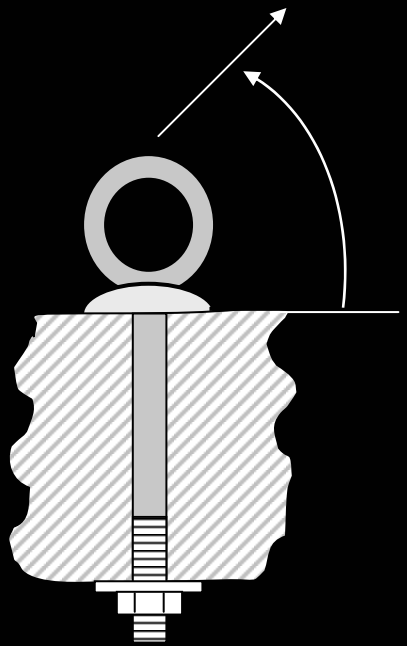
Vertical

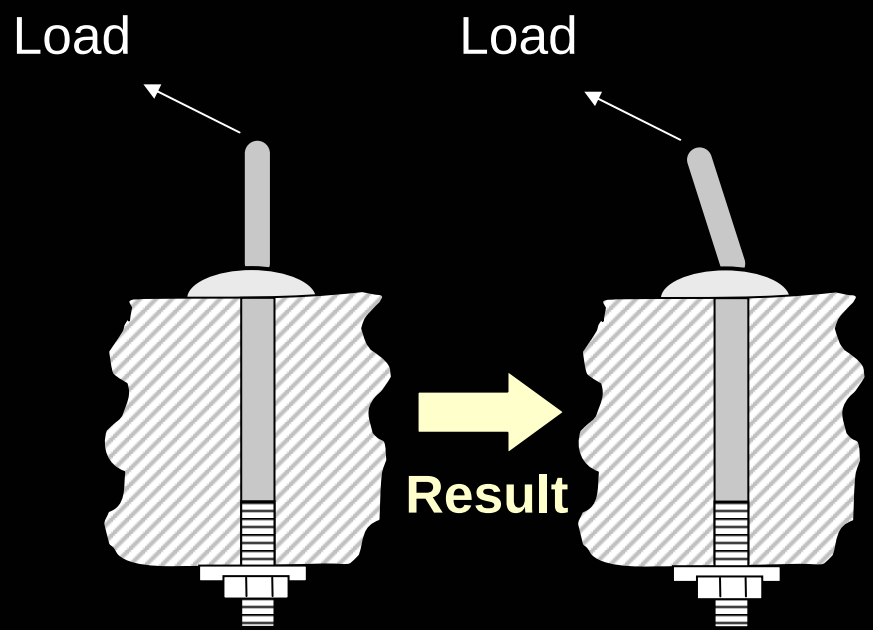
90 Degrees



Shouldered eyebolts may be loaded vertically and 90 degrees.

Orientation of Eyebolts



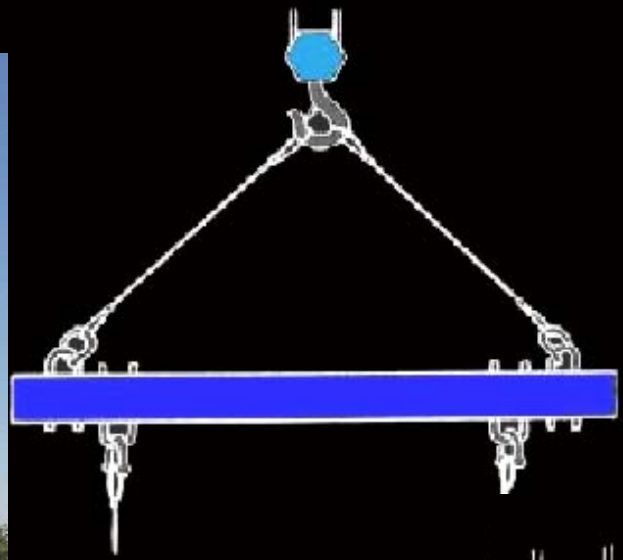


Correct Orientation – Load is in the plane of the eye.

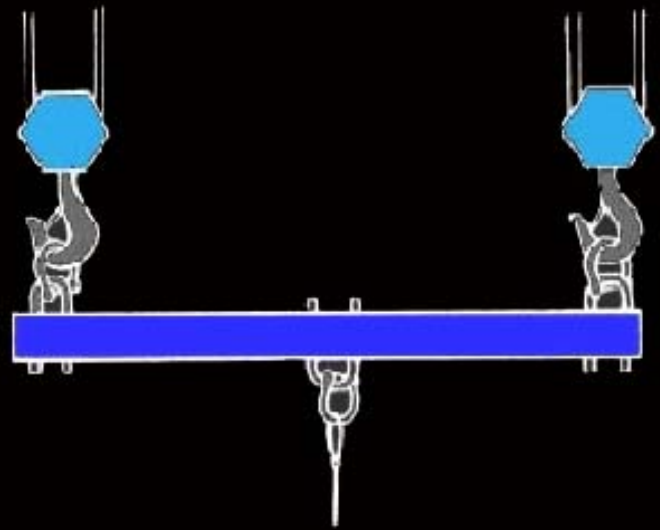
Incorrect Orientation – When the load is applied to the eye in this direction it will bend.

Always load an eyebolt in the plane of the eye.

Spreader Beams



Spreader Beam



Equalizer Beam

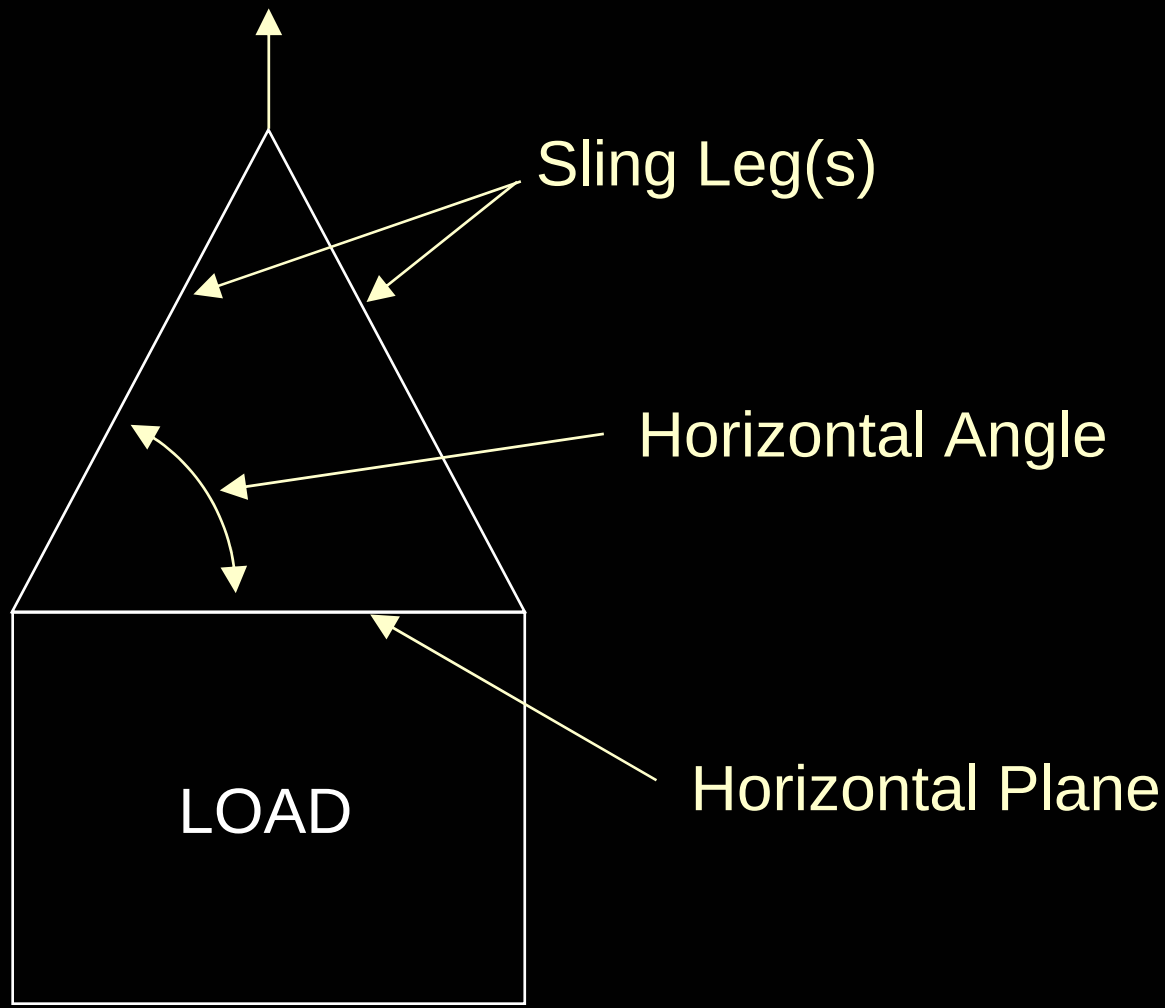
- Marked with the capacity and proof tested to 125 percent of that capacity
- Considered a load and cannot be left suspended unattended.

Slings

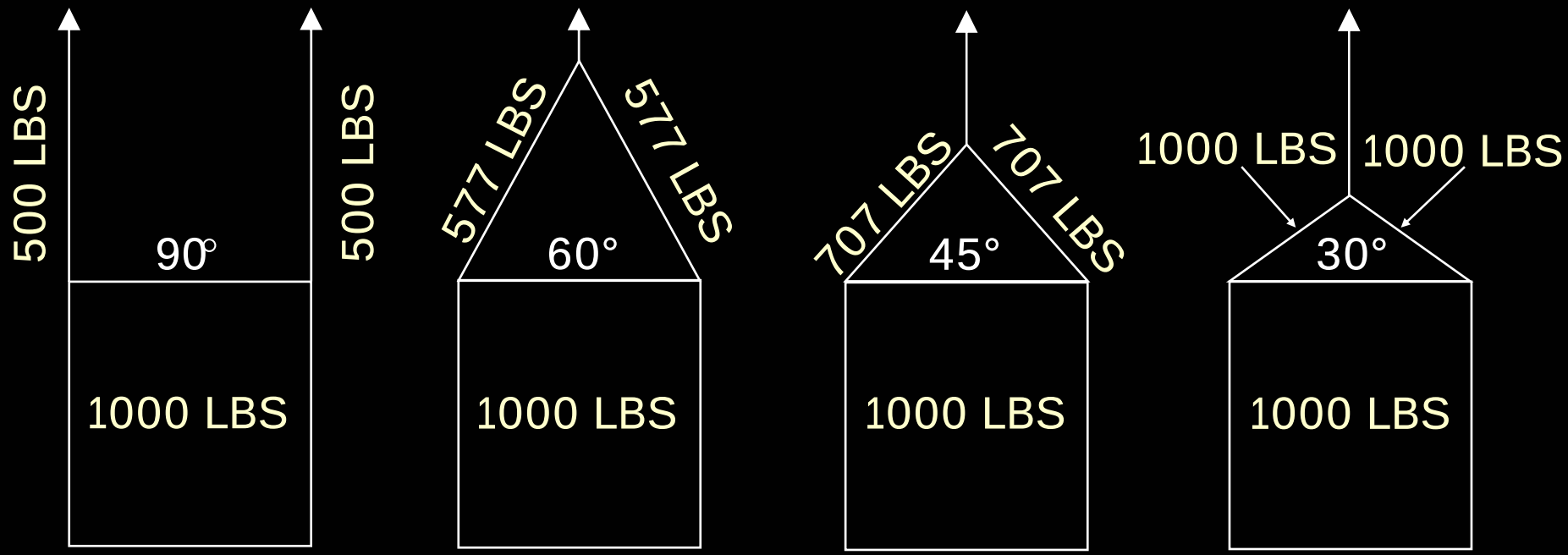
The following is a discussion on:

- Sling angles
- Sling tension
- Various types of hitches
- Various types of slings
- Inspections and maintenance

Sling Angles



How Horizontal Angle Affects Sling Capacity



Note: *A good operating practice is to keep sling angles from going below 60 degrees*

Sling Tension

Riggers and operators should know how to determine the sling tension based upon knowing:

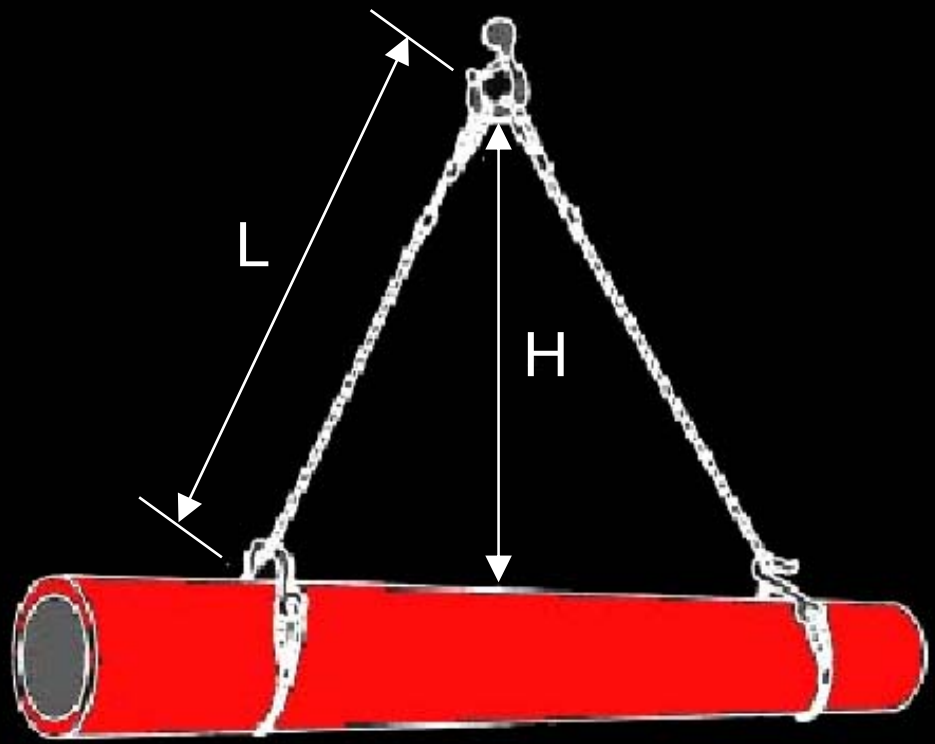
- Sling angle factor
- Total weight of the load
- Number of legs in the hitch

Sling Angle Factor

Sling Angle Factor = L/H

Where:

L = Length of the sling.
H = Height of the connection point from the horizontal plane of the load.

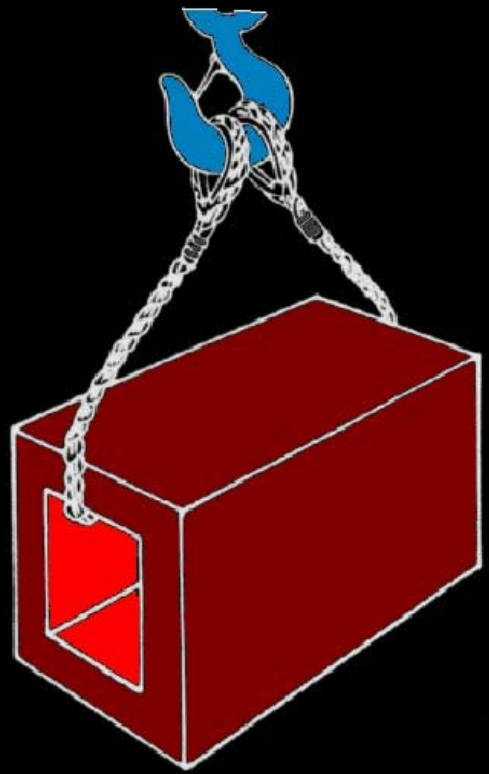


Types of Hitches

Straight Pull

Choker Hitch

Horizontal Angle



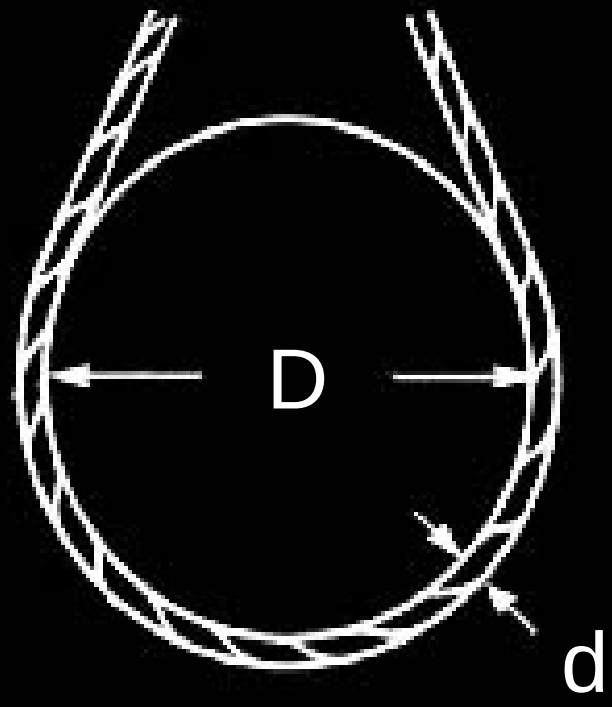
Basket Hitch

Strength Reduction for Choker Hitch

D:d Ratio

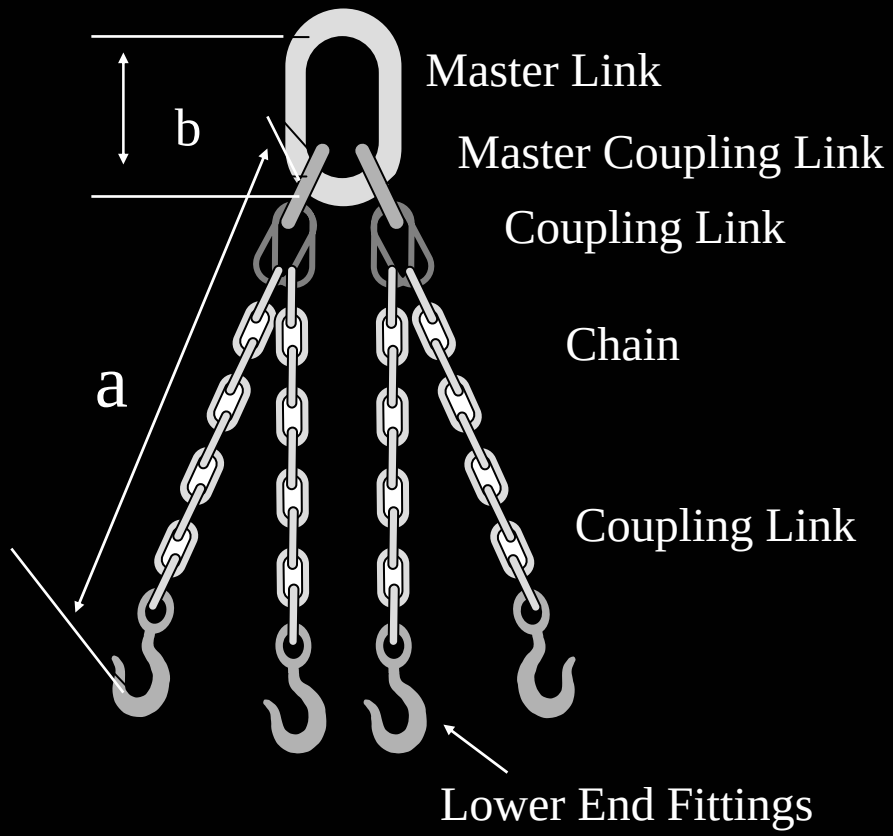
D - is diameter around which sling is bent.

d - is diameter of the sling.



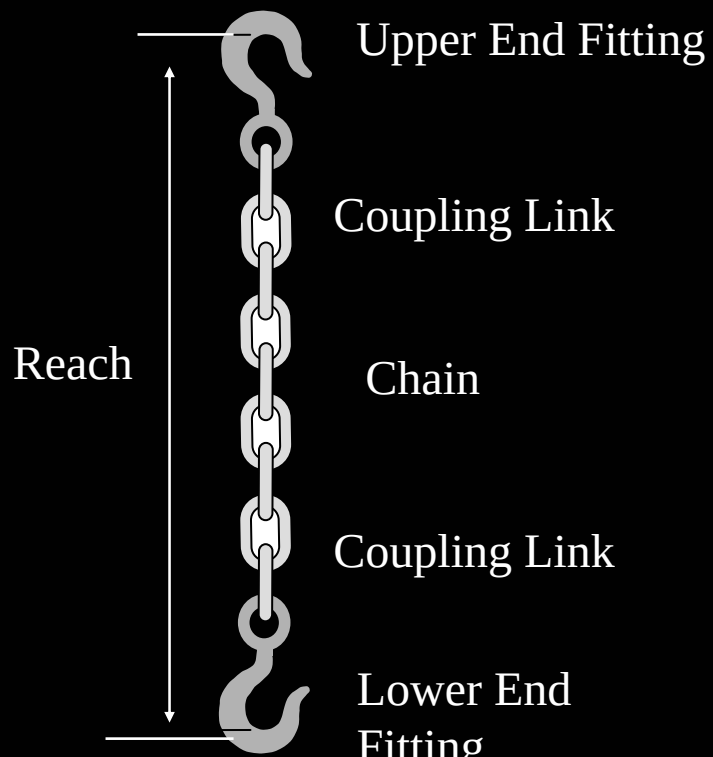
Alloy Steel Chain

Quadruple Leg Slings



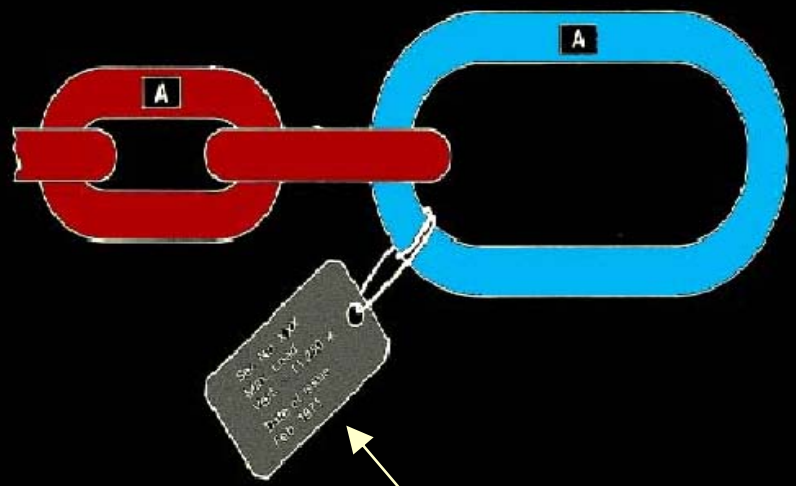
Reach = a + b

Single Leg Slings



Alloy Steel Chain Identification

- Chain Size
- Manufacturers Grade
- Rated load and angle
- Reach
- Number of legs
- Manufacturers name and trademark
- Next inspection



Identification Tag

Alloy Steel Chain Inspection

Frequent

- Visual examination by the user.

Periodic

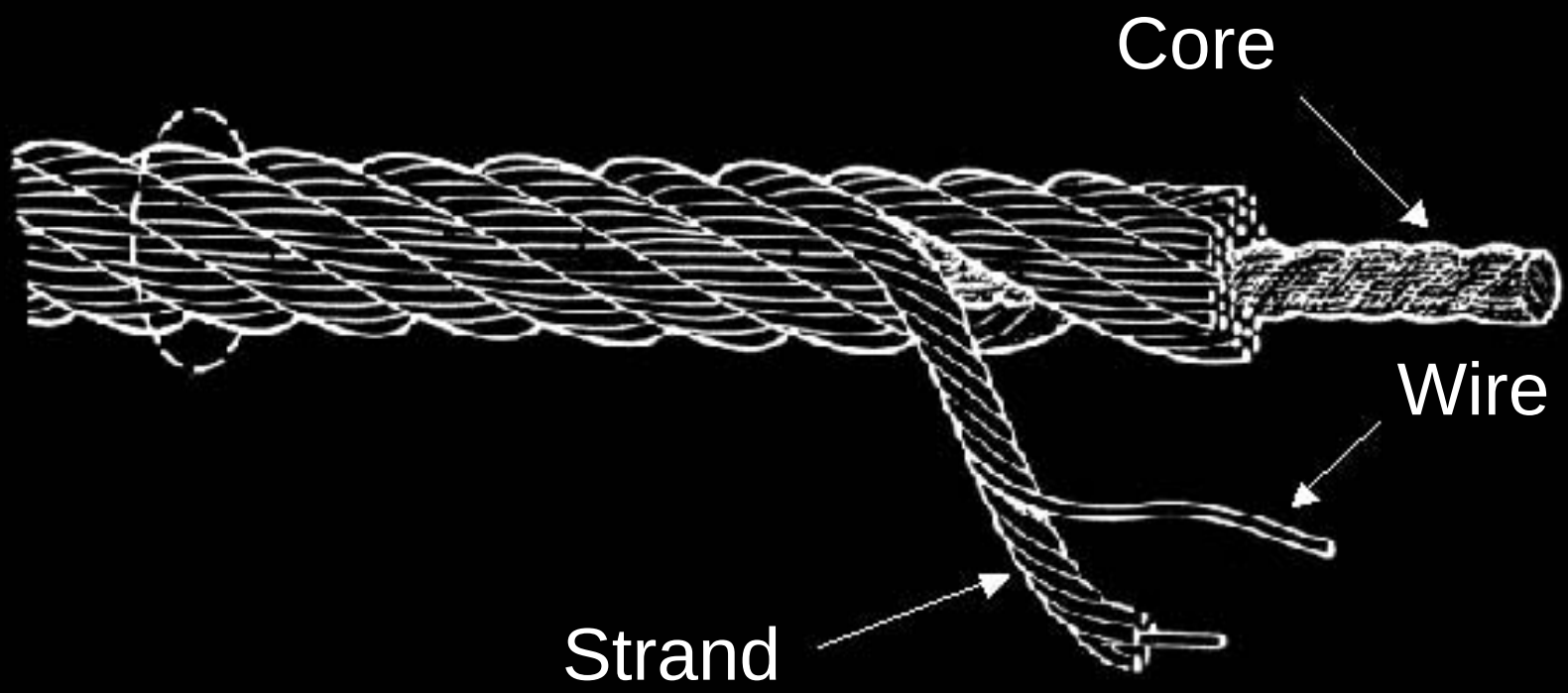
- Complete link by link inspection of the entire sling and all attachments.
- Documented

Alloy Steel Chain Inspection Items

- Twists or bends
- Nicks or gouges
- Excessive wear at bearing points
- Stretch
- Distorted or damaged master links

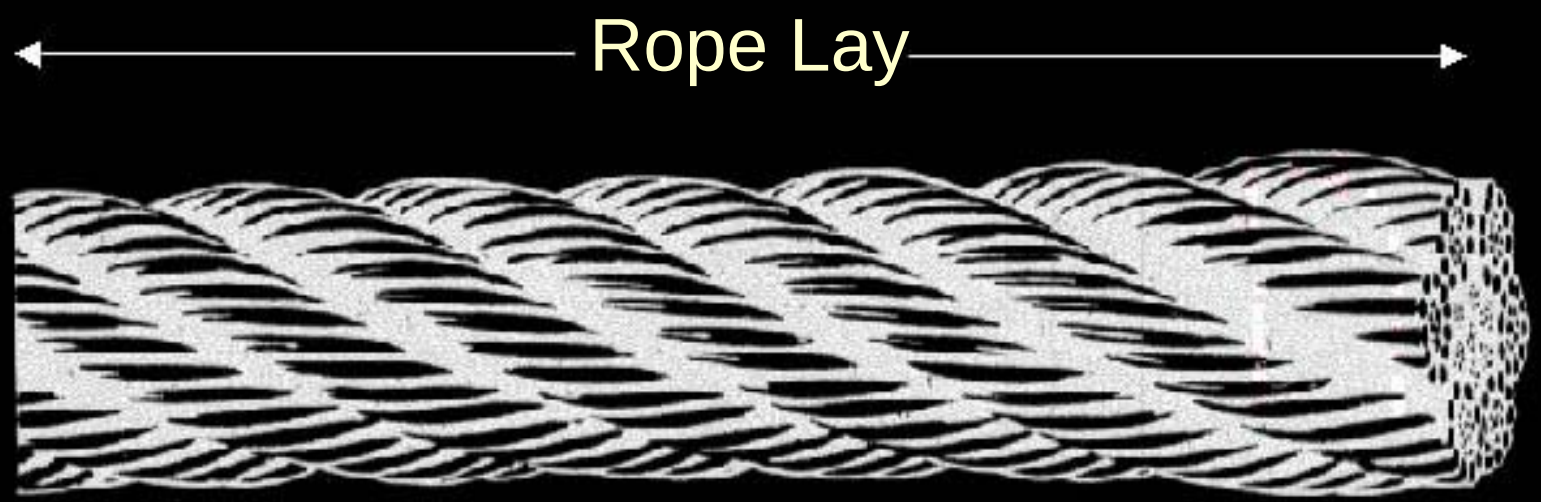
Wire Rope

Components



Wire Rope Lay

One complete wrap of a strand around the core



Wire Rope Lay

The direction the strands are wound around the core

Right Lay

Left Lay

Wire Rope Lay

Right Regular Lay

Right Lang Lay

Wire Rope Sling Identification

Non-Mandatory

- Rated Load (rated capacity)
- Load test date
- Manufacturer’s name
- Periodic inspection due date

Wire Rope Sling Inspection

- Broken wires (10 in one lay or 5 in one strand)
- Severe corrosion
- Localized wear
- Reduction in outer wire
- Damaged end fittings
- Distortion, kinking, etc…

Note: *If any of these conditions exist, the wire rope sling must not be used.*

Wire Rope Fatigue

Broken Wires

Wire Rope Abuse

Wire Rope “Bird Caging”

Wire Rope

- Field lubrication
- Storage
- Termination

Note: *Using the sling several times a week, even at a light load, is a good practice. Records show that slings that are used frequently or continuously give useful service far longer than those that are idle*

Fiber Rope & Synthetic Web

Fiber Rope

- Manila
- Grip load well and does not mar the surface.
- Not used around sharp edges or in hot environments.

Synthetic Web

- Nylon, polyester, dacron and polypropylene.
- Grip load well and does not mar the surface.
- Can take sharp edges better than fiber rope but stills needs to be protected.

Fiber Rope & Synthetic Web Identification

- Name or trademark of manufacturer.
- Manufacturers' code or stock number.
- Rated loads for the types of hitches used.
- Type of natural or synthetic materials.
- Date of manufacturer.

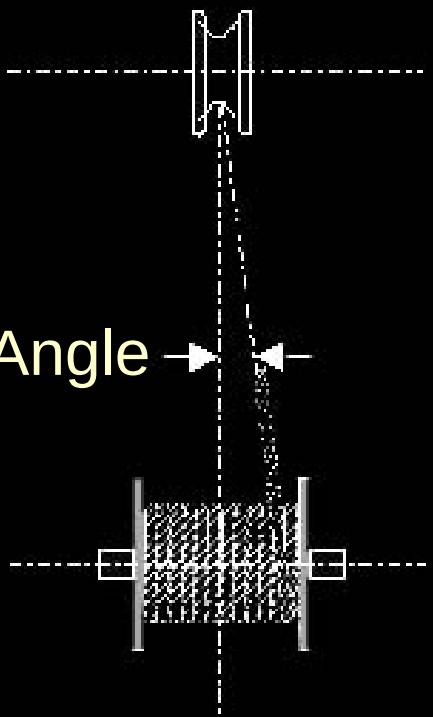
Fiber Rope & Synthetic Web Inspection

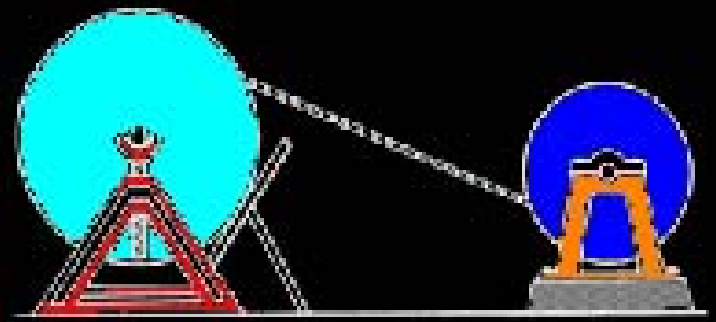
Fiber rope and synthetic web slings must be removed from service if any of the following defects exist:

- Cuts
- Worn surface
- Fiber breakage
- Discoloration
- Melted or charred
- Pitting or corrosion

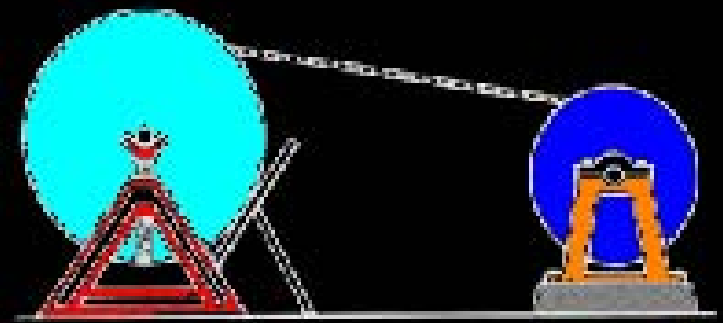
Main Hoisting Line

- Installed Correctly
- Inspected
- Maintained





Wrong Way to Wind



Right Way to Wind

Main Hoisting Line Inspection

Frequent

- Daily visual inspection.
- Observe rope during day's operations.

Periodic

- Determined by a qualified person.
- Based on rope life, severity of environment, percentage of capacity lifts, frequency, shock loads.

Main Hoisting Line Replacement

- Six randomly distributed broken wires in one lay or three broken wires in one strand in one lay.
- Kinking, crushing, birdcaging, or any other damage.
- More than two broken wires in one lay section beyond end connections.

Swinging Loads

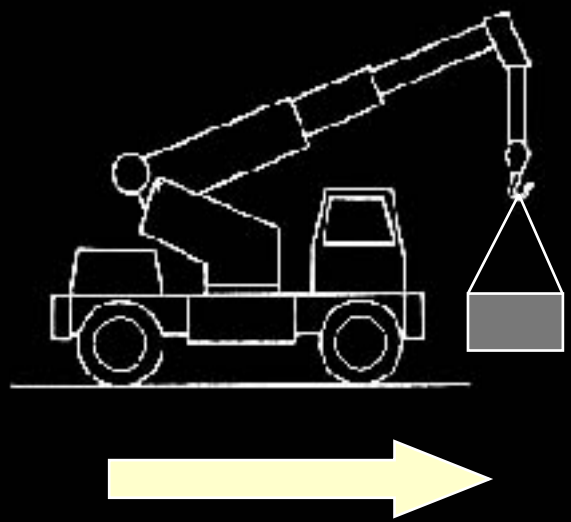
- Hand placement on and around suspended loads
- Traveling with the load
- Working in close proximity
- Making “blind picks”

Use Tag Line

This worker is at great risk of becoming off balance and could easily fall off the roof. Fall protection is required for this type of work.

Traveling with a Load

- Evaluate prevailing conditions
- Determine applicable safety precautions
- Check with crane manufacturer



When performing pick and carry operations, travel towards the load.

Precautions when Traveling with a Load

- Do not ride on the machine
- Crane should be lowered
- Check tire pressure
- Avoid sudden starts and stops
- Use tag lines
- Use a helper during “pick and carry”

Learning Opportunity

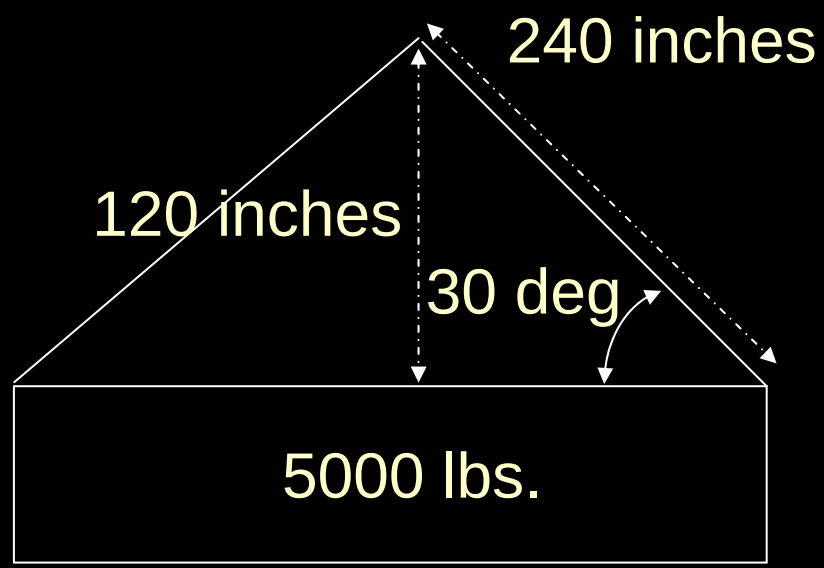
1. Hazards of being struck-by a falling or flying object while working around cranes and other material handling equipment include what two (2) things?

2. What four (4) things should take place in order to effectively manage the safe rigging and hoisting of loads?

Learning Opportunity Continued

3. Which sling(s) require written record of inspection?

4. Use the diagram provided to determine the sling angle factor and tension in each sling.



Other Hazards and Concerns

- Environmental hazards
- Performing critical lifts
- Using a crane suspended personnel platform
- Lifting a load with multiple cranes
- Mobile cranes mounted on barges

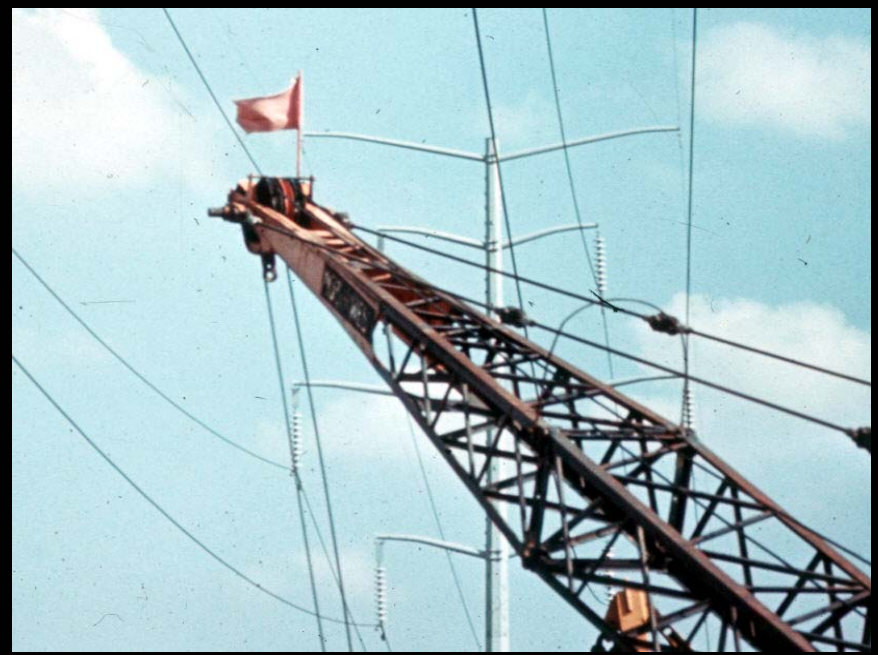
Environmental Hazards

- Protection from exhaust pipes
- Asphyxiation Hazards

Environmental Hazards

Working During Inclement Weather (High Winds):

- Procedures to responding to high wind alerts
- Procedures to coordinate with other cranes
- Procedures for securing cranes in high winds



Environmental Hazards

Working During Inclement Weather (Lightning & Thunderstorms)

Critical Lifts

Defined as:

- Potentially unacceptable risk of personnel injury or property damage
- Release of undesirable conditions
- Undetectable damage
- Significant work delay

Crane Suspended Personnel Platform

- OSHA & ANSI regulations must be thoroughly reviewed.
- Requirements for platform users and crane operators are reviewed.
- Pre-Lift meeting must be held.

Multiple Crane Lifts

Crane 1

Crane 2

Mobile Cranes Mounted on Barges

- Rated load must not exceed original capacity.
- Crane must be positively secured.
- Meet manufacturers' requirements.

Learning Opportunity

1. To keep a crane from toppling over during high winds and thunderstorms, what three (3) things can you do?

2. What four (4) conditions may turn an ordinary lift into a critical lift?

3. What four (4) general safety rules apply to crane operators when lifting personnel with a crane suspended personnel platform?